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Fellodistomidae (Trematoda, Digenea) from Deep-sea Fishes of Japan

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Abstract Six species of fellodistomid digeneans (Trematoda) were collected from deep-sea fishes at depths of 200 to 1,000 m off the Pacific coast of central and western Japan. Two new genera are proposed: *Pseudobenthotrema* gen. nov. for *Benthotrema richardsoni* Manter, 1954 and *Neomegalomyzon* gen. nov. for *N. physiculi* sp. nov. Three new species are described: *Benthotrema synaphobranchi* sp. nov. from *Synaphobranchus affinis* and *S. brevidorsalis* (Synaphobranchidae), *Lomasoma japonicum* sp. nov. from *Ateleopus japonicus* (Ateleopodidae), and *Neomegalomyzon physiculi* sp. nov. from *Physiculus maximowiczi* (Moridae). *Benthotrema* Manter, 1934 is emended to include *B. plenum* Manter, 1934 and *B. synaphobranchi* sp. nov. *Benthotrema hoplognathi* Yamaguti, 1938 is excluded from *Benthotrema* and considered synonymous with *Pseudosteringophorus hoplognathi* Yamaguti, 1940. Three previously known species are recorded: *Hypertrema ambovatum* Manter, 1960, *Steringophorus furciger* (Olsson, 1868) and *Piriforma macrorhamphosi* Yamaguti, 1938.

Key words: Digenea, Fellodistomidae, new genus, new species, deep-sea fish, Japan.

This paper deals with six species of the family Fellodistomidae (Trematoda, Digenea) from deep-sea fishes of Suruga Bay and Tosa Bay, off the Pacific coast of central and western Japan. Fishes were collected mainly by commercial trawl at depths varying from 200 to 1,000 m. Digeneans obtained were washed in saline, fixed in AFA under slight pressure, stained with Heidenhain's hematoxylin and mounted in Canada balsam. Sectioned material was stained with Delafield's hematoxylin with eosin as a counterstain. The specimens are deposited in the Meguro Parasitological Museum (MPM) and the National Museum of Nature and Science, Tokyo (NSMT). Measurements are given in millimeters unless otherwise indicated. We thank Drs. Eric P. Hoberg and Patricia A. Pilitt, the United States National Parasite Collection (USNPC) for the loan of specimens. Thanks are also due to Dr. Rodney A. Bray who gave us valuable comments to improve the manuscript.

Subfamily Fellodistominae Nicoll, 1909

Genus ***Benthotrema*** Manter, 1934

Original diagnosis (Manter, 1934): Fellodistominae of plump, thick body form, median to large sized, without folds; suckers approximately equal in size; esophagus short and broad; genital pore to the left, with radiating muscles; cirrus sac ovoid; seminal vesicle coiled, not bipartite; genital atrium without genital lobes; testes smooth, symmetrical; ovary unlobed, anterior to testes; vitellaria of numerous pigmented follicles and entirely anterior to midbody; eggs dark brown, with spiny shells.

Emended diagnosis: Body large, elliptical, rounded at both ends. Acetabulum small, rounded, about equal in size as oral sucker, about 1/3 from anterior end. Prepharynx absent or short.

[†]Deceased February 5, 2001

Pharynx small. Esophagus short. Intestinal bifurcation in mid-forebody. Caeca extending beyond testes to midlevel of hindbody. Testes oval, entire, symmetrical, immediately posterior to acetabulum. Cirrus sac broadly claviform, just preacetabular. Internal seminal vesicle unipartite or bipartite. Pars prostatica and prostatic cells well-developed. Ejaculatory duct short. Genital atrium shallow, without recess. Genital pore slightly sinistral, between intestinal bifurcation and acetabulum. Ovary rounded, entire, immediately anterior to right testis, a little posterodextral to acetabulum. Mehlis' gland well-developed, just posterior to acetabulum. Uterus mainly in posttesticular region. Eggs thick-shelled, covered with small spines. Vitelline follicles irregular in shape, in two lateral fields between intestinal bifurcation and testes, overlapping caeca. Excretory vesicle with arms extending to pharyngeal level. Parasitic in deep-sea teleosts.

Type species: *Benthotrema plenum* Manter, 1934.

Other species: *B. synaphobranchi* sp. nov.

Remarks. Benthotrema was originally established by Manter (1934) based on the type and only species, *B. plenum* Manter, 1934. Five additional species have subsequently been assigned in the genus, that is, *B. hoplognathi* Yamaguti, 1938, *B. richardsoni* Manter, 1954, *B. hilsii* Zaidi and Khan, 1977, *B. melanostigmi* Parukhin and Lyadov, 1979 and *B. pyriformis* Wang, 1987. Bray (2002) considered a unipartite seminal vesicle one of the generic characters of *Benthotrema*, and included *Benthotrema* in a group possessing a unipartite seminal vesicle in his key to genera of the subfamily Fellodistominae. Our *Benthotrema synaphobranchi* sp. nov. described below is very similar to *B. plenum*. The only difference between the two is that the seminal vesicle in *B. plenum* is unipartite and that of our species is bipartite. Taking all other similarities such as body shape, extent of caeca posterior to testes, distribution of vitellaria, eggs with small spines, etc. between *B. plenum* and *B. synaphobranchi* into consideration, the unipartite or bipartite nature of the seminal vesicle is regarded as a character that distinguishes species within *Benthotrema*.

Concerning the five additional species designated as *Benthotrema*, we are in doubt as to their placement in *Benthotrema* as discussed below. Thus we propose the above emended diagnosis of *Benthotrema*, in which only two species from deep-sea fishes, *B. plenum* and *B. synaphobranchi*, are included.

1) Manter (1954) and Bray (2002) pointed out that *Benthotrema hoplognathi* Yamaguti, 1938 is closely related to *Pseudosteringophorus hoplognathi* Yamaguti, 1940. Both species are from fishes of the genus *Hoplognathus* (now *Oplegnathus*), and resemble each other in possessing caeca that extend only to the acetabular level, a bipartite seminal vesicle, preacetabular vitellaria and eggs without spines. When Yamaguti (1940) erected *Pseudosteringophorus* with *P. hoplognathi* as the type species, he did not compare it with *Benthotrema*. According to his descriptions, *P. hoplognathi* seems to differ from *B. hoplognathi* primarily in that the former has a genital atrium with a recess totally lined with hairs and surrounded by glandular cells, whereas the latter has a seminal receptacle. Eight specimens of *B. hoplognathi* are preserved in the MPM (MPM Coll. 23040). The holotype, which Yamaguti illustrated (1938, Fig. 56), is broken into pieces, and other six paratypes are not in condition to examine in detail. The remaining specimen shows that the genital atrium has a saccular recess, totally lined with villous hairs and surrounded by glandular cells. These features are the same as those of *P. hoplognathi*. The seminal receptacle cannot be confirmed.

We also examined Yamaguti's specimens of *P. hoplognathi* (MPM Coll. 23037). They are small in size (body 1.1–1.8 long) and slightly macerated. Yamaguti (1940) described them in detail and nothing more need be mentioned here. He wrote "no receptaculum seminis." Many specimens identified as *P. hoplognathi* were collected by one of us (M. M.) from *Oplegnathus fasciatus* at the Tokyo Wholesale Market (NSMT-Pl 798). They are larger than Yamaguti's specimens and can be divided into two groups. In one group, the speci-

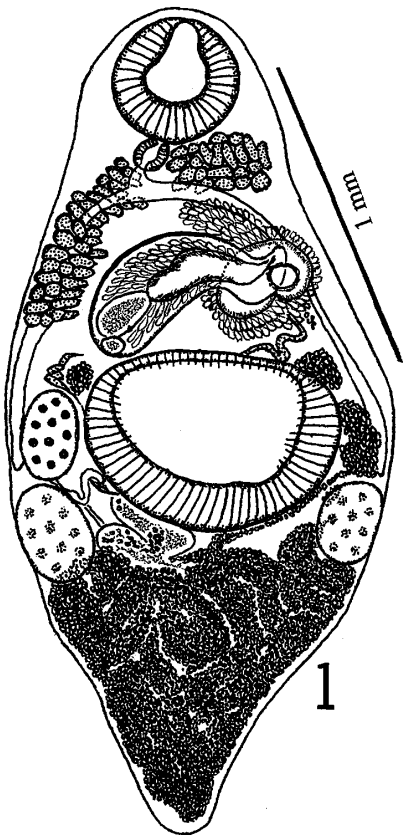


Fig. 1. *Pseudosteringophorus hoplognathi* Yamaguti, 1940. Entire worm, ventral view (original, NSMT-Pl 798).

mens have larger bodies with correspondingly larger organs except egg size. Ten specimens (Fig. 1) are 2.33–2.88 long by 1.15–1.43 wide. Oral sucker 0.34–0.45×0.34–0.42. Acetabulum 0.49–0.69×0.68–0.90. Sucker ratio 1 : 1.8–2.4. Forebody 48–54% of body length. Right testis 0.28–0.34×0.20–0.28 and left testis 0.25–0.32× 0.18–0.24. Cirrus sac 0.66–0.74×0.24–0.29, containing bipartite seminal vesicle, pars prostatica with prostatic cells, and cirrus which protrudes into genital atrium. Genital atrium with recess, both lined with villous hairs and surrounded by glandular cells. Ovary 0.23–0.32×0.15–0.20. Eggs 21–24×15–16 μm. Vitellaria in two clusters; right cluster dextral to and left cluster anterior to cirrus sac, respectively. In the other group, the specimens have slightly smaller bodies. Four specimens are 2.02–2.38 long by 0.67–0.78 wide. Oral sucker 0.21–0.24×0.16–0.21. Acetabulum 0.26–0.34×0.28–0.37. Sucker ratio 1 : 1.6–1.8. Forebody 43–52% of body length. Right testis 0.20–0.29×0.17–0.24 and left testis 0.21–0.26× 0.17–0.21. Cirrus sac 0.52–0.57×0.18–0.20. Terminal genitalia are the same structure as the aforementioned group. Ovary 0.18–0.24×0.09– 0.19. Eggs 23–26×13–16 μm. In our specimens, no evidence of a seminal receptacle is observed. The proximal end of the uterus is inflated like a sac filled with sperm. Yamaguti (1938) might have mistaken it for an oval seminal receptacle in his description of *B. hoplognathi*.

As mentioned above, examination of Yamaguti's and our own specimens indicated that there is no significant differences between *B. hoplognathi* and *P. hoplognathi*. *Benthotrema hoplognathi* is therefore transferred to *Pseudosteringophorus* and placed as a synonym of *P. hoplognathi*.

2) *Benthotrema richardsoni* Manter, 1954 cannot be included in our emended *Benthotrema*. As a result of our examination of the holotype (USNPC 49139), we have found that this species differs from our *Benthotrema* chiefly by caeca ending at the pre- to midacetabular level, not reaching the testes; an acetabulum near the midbody and much smaller than the oral sucker; vitellaria filling most of the area between the suckers; and eggs without spines. It differs from *Pseudosteringophorus* by possessing a unipartite seminal vesicle, no cirrus, a genital atrium without a recess, and the vitellaria filling most of the area between the suckers. We propose a new genus *Pseudobenthotrema* for *B. richardsoni*.

Genus ***Pseudobenthotrema*** gen. nov.

Diagnosis: Body small, linguiform, widest in anterior half, rounded at both ends. Acetabulum near midbody, smaller than oral sucker. Prepharynx absent. Pharynx small. Esophagus lacking. Caeca ending at pre- to midacetabular level, not reaching testes. Testes spherical, entire, symmetrical, posterolateral to or partly overlapping acetabulum. Cirrus sac elongated, lying diagonally or almost horizontally, preacetabular. Internal seminal vesicle coiled tubular, not bipartite. Pars

prostatica saccular, with prostatic cells. Cirrus lacking. Genital atrium without recess, surrounded by glandular cells. Genital pore slightly sinistral, just anterior to acetabulum. Ovary spherical, entire, dextral to acetabulum, immediately anterior to right testis. Mehlis' gland between ovary and cirrus sac. Uterus in posttesticular region. Eggs thick-shelled, without spines. Vitelline follicles small, filling most of area between suckers. Excretory vesicle Y-shaped, stem inflated, bifurcating just posterior to acetabulum, arms reaching lateral to oral sucker. Parasitic in marine teleosts.

Type- and only species: *Pseudobenthotrema richardsoni* (Manter, 1954) comb. nov.

3) Bray (2002) pointed out that *Benthotrema hilsii* Zaidi and Khan, 1977 was not well enough known for useful comparison to be made. The original description and illustration given by Zaidi and Khan (1977) are insufficiently detailed for an informed discussion of the proper status of this species.

4) Bray and Campbell (1995) considered *Benthotrema melanostigmi* Parukhin and Lyadov, 1979 a possible synonym of *Steringophorus melanostigma* (Noble and Orias, 1975). Both species are from fishes of the genus *Melanostigma*, and resemble each other in having a cirrus sac on or just exterior to the left caecum, vitellaria in the acetabulotesticular zone, etc. We agree with Bray and Campbell's suggestion.

5) *Benthotrema pyriformis* Wang, 1987 appeared in Wang's paper (1987, actually published in 1989). However, the name was listed only in his paper without any description of the species.

Benthotrema synaphobranchi sp. nov.

(Figs. 2–5)

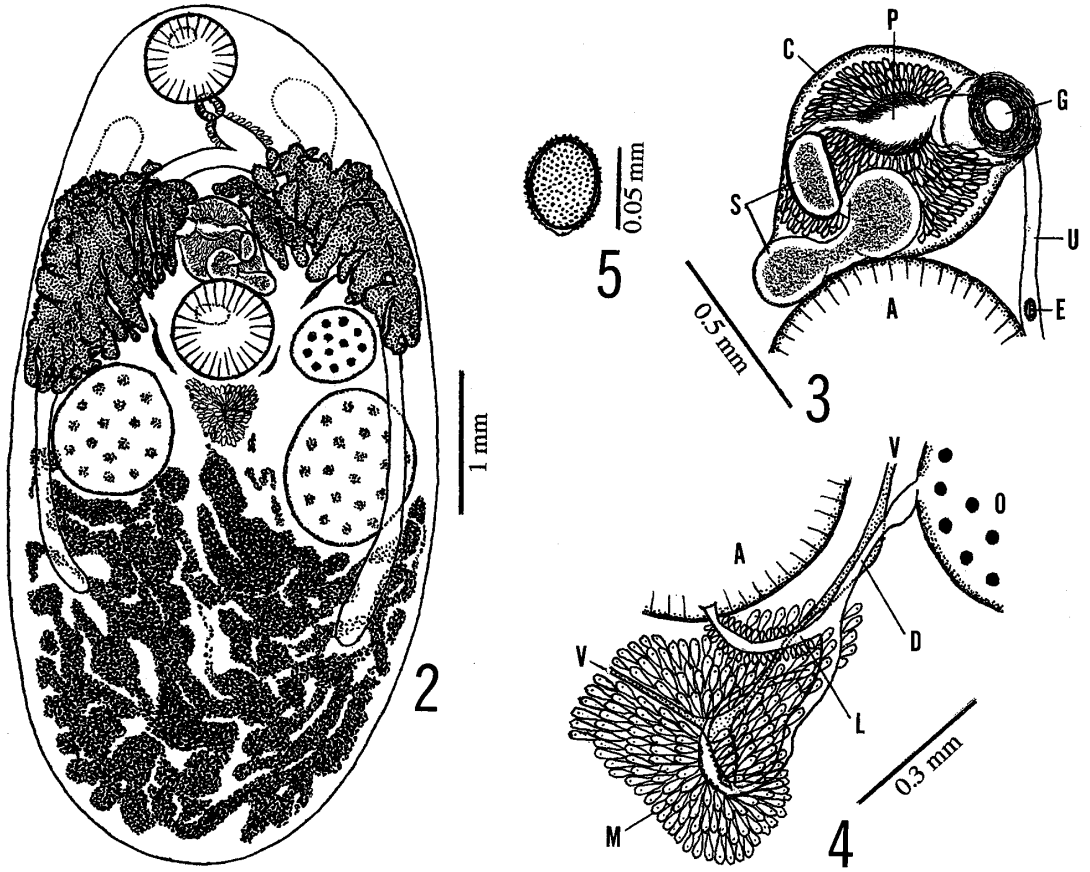
Fellodistomum sp. Kuramochi, 2001: 20, figs. 1–3.

Material. One specimen from intestine of *Synaphobranchus affinis* Günther (Synaphobranchidae), Suruga Bay, 21-XI-1993 (NSMT-Pl 4513b, holotype), coll. M. Machida; and one specimen from intestine of *S. brevidorsalis* Günther, Tosa Bay, 2-III-1999 (NSMT-Pl 5100, paratype, *Fellodistomum* sp. of Kuramochi (2001)), coll. T. Kuramochi.

Description. Based on two specimens. Body large, elliptical, rounded at both ends, 5.95–7.90 long by 2.98–3.50 wide (Fig. 2). Tegument smooth. Oral sucker subterminal, 0.59–0.72× 0.67–0.75; prepharynx very short, 0.04–0.05 long; pharynx partly overlapping posterior portion of oral sucker, 0.18–0.19×0.20–0.29; esophagus short, 0.31–0.35 long, surrounded by glandular cells, bifurcating approximately midway between suckers; caeca passing beyond testes and ending near midlevel of hindbody. Acetabulum 0.70–0.81×0.71–0.77. Sucker ratio 1 : 1.03–1.06. Forebody 32–38% of body length.

Testes rounded to ovoid, symmetrical, immediately postacetabular; right testis 0.70–1.15× 0.65–0.95 and left testis 0.98–0.99×0.60–0.87. Posttesticular space 38–49% of body length. Cirrus sac ovoid, tapering posteriorly, 0.84–0.95× 0.30–0.60, extending posteriorly near midacetabular level, containing seminal vesicle, pars prostatica with well-developed prostatic cells and ejaculatory duct. Internal seminal vesicle bipartite; proximal portion thin-walled, tubular, straight or slightly twisted and distal portion relatively thick-walled, saccular, 0.17–0.25×0.13–0.15; pars prostatica 0.24–0.35 long, with fairly thick wall and ejaculatory duct ovoid or cup-shaped. Genital atrium shallow, without recess. Genital pore with thick wall, slightly sinistral, midway between intestinal bifurcation and acetabulum (Fig. 3).

Ovary globular, smooth, 0.57–0.73×0.60–0.63, immediately anterior to right testis, slightly posterodextral to acetabulum. Oviduct arising from left margin of ovary, running posterosinistrally, giving off Laurer's canal, receiving vitelline reservoir, then entering Mehlis' gland. Laurer's canal short, enclosed by small glandular cells, opening mid-dorsally near posterior border of acetabulum. Mehlis' gland well-developed, immediately posterior to acetabulum (Fig. 4). Uterus filling available space of hindbody, then passing for-



Figs. 2–5. *Benthotrema synaphobranchi* sp. nov. — 2. Entire worm, dorsal view (holotype, NSMT-Pl 4513b). 3. Terminal genitalia, ventral view. 4. Ovarian complex, dorsal view. 5. Egg. Abbreviations: A, acetabulum; C, cirrus sac; D, oviduct; E, egg; G, genital pore; L, Laurer's canal; M, Mehlis' gland; O, ovary; P, pars prostatica; S, seminal vesicle; U, uterus; V, vitelline duct.

ward on left side of acetabulum. Metraterm not observed. Eggs 56–59×35–50 μm, covered with small spines and sometimes with small process at anopercular end (Fig. 5). Vitelline follicles irregular in shape, in two lateral fields, overlapping caeca dorsally, between intestinal bifurcation and ovarian to testicular level. Excretory vesicle not visible posteriorly obscured by numerous eggs, arms extending to pharyngeal level; pore terminal.

Remarks. *Benthotrema synaphobranchi* differs from *B. plenum* Manter, 1934 in having a bipartite rather than a unipartite seminal vesicle. Manter (1934) described *B. plenum* based on a single specimen. He wrote "seminal vesicle a coiled tube, not evidently bipartite." Our examination of the holotype (USNPC type 8681) revealed the tubular seminal vesicle to be entirely thin walled and it is reflexed close to the middle, but it is not divided. Our species has a distinct bipartite seminal vesicle, the proximal tubular portion with a thin wall and the distal saccular portion with a thick wall. The unipartite or bipartite seminal vesicle is often used in fellodistomids as a generic character. As discussed above, we consider the feature of the seminal vesicle a character that separates species in *Benthotrema*, and emend the diagnosis of *Benthotrema* to include two species, *B. plenum* and *B. synaphobranchi*.

Genus ***Hypertrema*** Manter, 1960

Hypertrema ambovatum Manter, 1960

(Fig. 6)

Material. Twenty specimens from intestine of *Synaphobranchus affinis* Günther (Synaphobranchidae), Suruga Bay, 20-IV-1973 (MPM Coll. 18068), coll. Sh. Kamegai; and 17 specimens from intestine of *Congriscus megastomus*

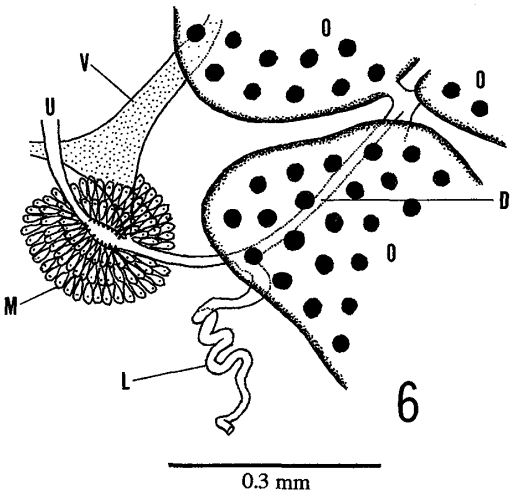


Fig. 6. *Hypertrema ambovatum* Manter, 1960. Ovarian complex, dorsal view (NSMT-Pl 4487). Abbreviations: D, oviduct; L, Laurer's canal; M, Mehlis' gland; O, ovary; U, uterus; V, vitelline duct.

(Günther) (Congridae), Suruga Bay, 17-XI-1993 (NSMT-Pl 4487), coll. M. Machida.

Remarks. This species has been recorded from *Synaphobranchus affinis* and *Congriscus megastomus* off the Pacific coast of central and western Japan (Kamegai, 1974; Machida and Kamegai, 1997; Kuramochi, 2001). As pointed out by Bray and Gibson (1998), the tegument of this worm is covered with fine spines. The ovary usually consists of three lobes, but rarely two or four lobes. The ovarian complex is illustrated in Fig. 6.

Genus ***Lomasoma*** Manter, 1935

Lomasoma japonicum sp. nov.

(Figs. 7–10)

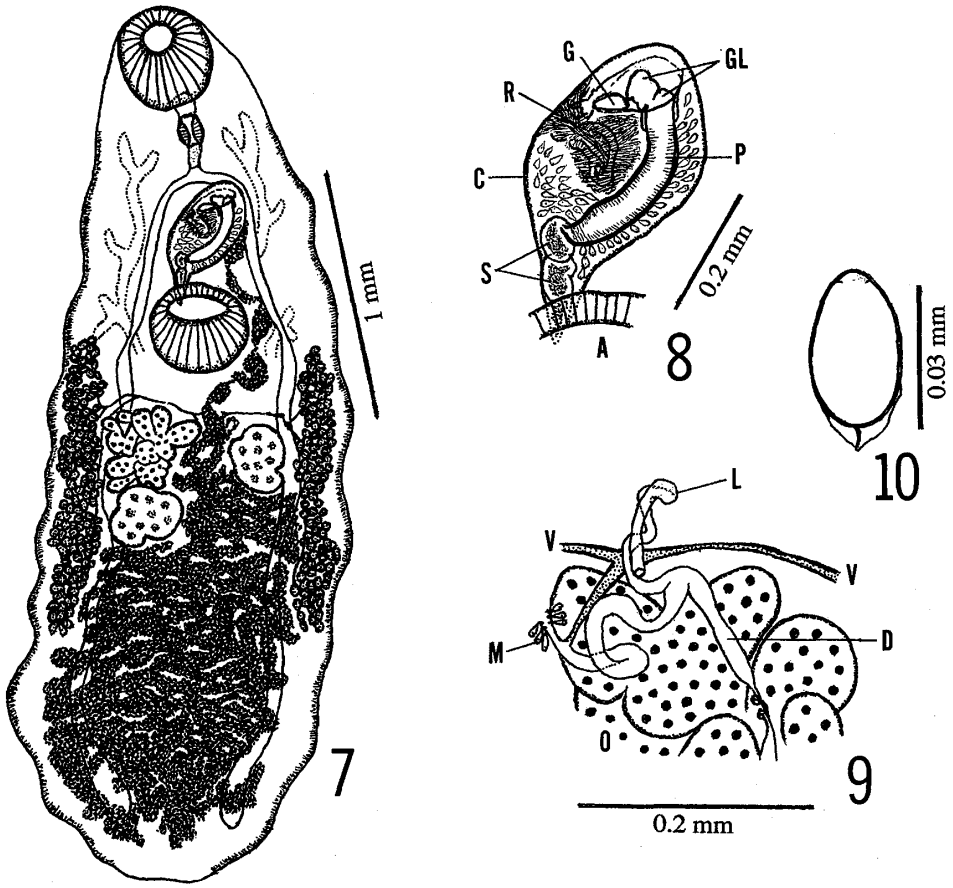
Lomasoma sp. Kamegai, 1974: 1615–1616.

Material. One specimen from intestine of *Ateleopus japonicus* Bleeker (Ateleopodidae), Suruga Bay, 21-IV-1973 (MPM Coll. 18080, holotype, *Lomasoma* sp. of Kamegai (1974)), coll. Sh. Kamegai; and one immature specimen from intestine of *Polymixia japonica* Günther (Polymixiidae), Suruga Bay, 29-IV-1973 (MPM Coll. 18178, juvenile *Lomasoma* sp. of Kamegai (1974)), coll. Sh. Kamegai.

Description. Based on one gravid specimen. Body elongated, tapering anteriorly and rounded posteriorly, 3.34 long by 1.19 wide, with seven to eight lateral, outer expansions on each side (Fig. 7). Tegument smooth. Transversely elongated muscle cells lining lateral sides of body. Oral sucker subterminal, 0.38×0.36; prepharynx 0.11 long; pharynx 0.13×0.12; esophagus muscular, 0.10 long, bifurcating nearer oral sucker than acetabulum; caeca extending near posterior extremity of body. Acetabulum 0.34×0.39. Sucker ratio 1 : 0.92. Forebody 37% of body length.

Testes with irregular outline, diagonal, intercaecal; right testis 0.26×0.32, immediately posterior to ovary and left testis 0.34×0.22, sinistral to ovary with uterus between. Posttesticular space 37% of body length. Cirrus sac 0.48×0.26, abruptly narrowed and pointed posteriorly, occupied intercaecal and preacetabular space, and partly overlapping forward portion of acetabulum. Internal seminal vesicle bipartite; proximal portion tubular, slightly convoluted, 0.14 long and distal portion saccular, 0.08×0.06. Pars prostatica slender, arcuate, 0.30×0.06, with muscular thick wall. Wall of pars prostatica continuous with genital lobes. Two muscular genital lobes, subventral lobe smaller than subdorsal one, both projecting into genital atrium. Genital atrium ovoid, with labyrinthine atrial recess which is surrounded by well-developed muscles. Both genital atrium and atrial recess enclosed in cirrus sac. Genital pore slightly sinistral, shortly postbifurcal (Fig. 8).

Ovary multilobed, 0.36×0.37, some distance posterodextral to acetabulum, in contact with anterior border of right testis, overlapping right caecum. Oviduct arising from center of ovary, thin, making two loops, then thickens before giving off Laurer's canal, and winding, receiving common vitelline duct. Mehlis' gland near anterosinistral edge of ovary. Laurer's canal convoluted, opening mid-dorsally at preovarian level (Fig. 9). Uterus filling posttesticular space, then extending forward between left testis and ovary, on left side of acetabulum and cirrus sac. Eggs with two shells. Outer shell thin membranous, distinct in anopercular half; inner shell thick, 30–35×15–



Figs. 7–10. *Lomasoma japonicum* sp. nov. — 7. Entire worm, ventral view (holotype, MPM Coll. 18080). 8. Terminal genitalia, ventral view. 9. Ovarian complex, dorsal view. 10. Egg. Abbreviations: A, acetabulum; C, cirrus sac; D, oviduct; G, genital pore; GL, genital lobe; L, Laurer's canal; M, Mehlis' gland; O, ovary; P, pars prostatica; R, atrial recess; S, seminal vesicle; V, vitelline duct.

20 μm, with slender, slightly twisted process (5–8 μm long) at anopercular end (Fig. 10). Vitellaria composed of small follicles in two lateral, extracaecal fields, extending from midacetabular level to approximately middle of posttesticular region. Excretory vesicle V-shaped, arms crossing caeca at acetabular level, diverticulated in forebody, and reaching to pharyngeal level; pore sub-dorsal.

Immature specimen from *Polymixia japonica* (MPM Coll. 18178). Body 2.9×1.8, with seven lateral outer expansions on each side. Oral sucker 0.28×0.27. Prepharynx 0.14 long. Pharynx 0.11×0.11. Esophagus 0.21 long. Acetabulum 0.25×0.25. Sucker ratio 1 : 0.92. Forebody 36% of body length. Right testis inverted heart-shaped, 0.27×0.28 and left testis elliptical, 0.35×0.18. Posttesticular space 32% of body length. Cirrus sac 0.38×0.18. Ovary 0.36×0.24.

Remarks. Six other species of *Lomasoma* have been described: *L. wardi* (Manter, 1934) (type species), *L. monolenei* (Manter, 1934), *L. gracile* (Manter, 1934), *L. stefanskii* Dollfus, 1960, *L. kergeleni* Parukhin and Lyadov, 1979 and *L. triglae* Bartoli, Kostadinova and Gibson, 2007. Bray and Campbell (1995) stated that *L. kergeleni* was very similar to *Steringophorus pritchardae* (Campbell, 1975). Because of having a slender body with entire, tandem testes, *L. kergeleni* may be a synonym of *S. pritchardae*. The present new species resembles *L. gracile* and *L. stefanskii* in lacking ventro-lateral lobes on each side of the body. However, it differs from both by having a labyrinthine atrial recess associated with the genital atrium. Figures illustrated by Bartoli *et al.* (2007, Figs. 8 and 11) do not

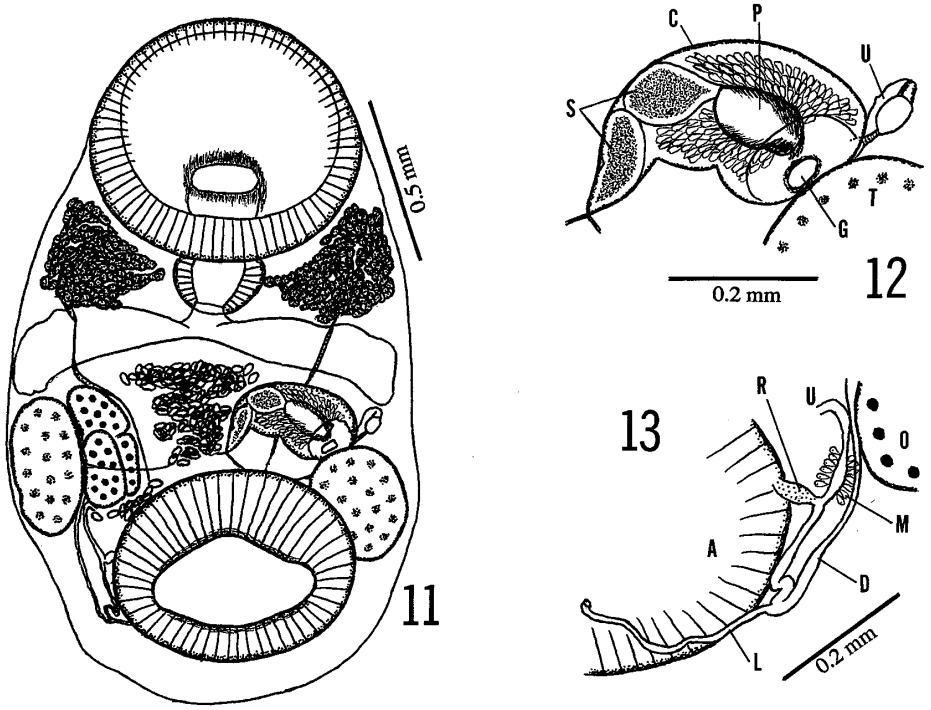
show any labyrinthine recess attached to the genital atrium in either *L. gracile* or *L. stefanskii*. The function of the labyrinthine atrial recess in our species is unclear and this feature has not been described for any other species of *Lomasoma*.

Genus ***Neomegalomyzon*** gen. nov.

Diagnosis: Body ovoid, robust. Oral sucker very large, rounded. Prepharynx longer than esophagus; pharynx ovoid, in contact with oral sucker; esophagus short; caeca broad and short, extending transversely, then turning posteriorly at each end, and ending just or slightly anterior to each testis. Acetabulum large, ovoid, a little smaller than oral sucker, near posterior end of body. Testes rounded to oval, entire, symmetrical, between caecal termination and acetabulum. Cirrus sac broadly claviform, horizontally, tapering proximally, sinistral, between left caecum and acetabulum. Internal seminal vesicle bipartite. Pars prostatica elliptical, surrounded by well-developed prostatic cells. Ejaculatory duct inconspicuous. Genital atrium bowl-shaped. Genital pore on anterodextral edge of left testis. Ovary trilobed, contiguous with left side of right testis. Uterus between caeca and acetabulum, not invading postacetabular area. Vitellaria in two lateral fields, at pharyngeal level. Excretory vesicle V-shaped, with arms extending to near caeca; pore terminal. Parasitic in deep-sea teleosts.

Type- and only species: *Neomegalomyzon physiculi* sp. nov.

Remarks. *Neomegalomyzon* is most similar to *Megalomyzon* Manter, 1947, but differs from it by having an acetabulum near the posterior end of the body; a uterus in the middle of the body, not extending into the postacetabular area; a genital pore at the anterodextral edge of the left testis; and a V-shaped excretory vesicle with arms reaching the caeca. Manter (1947) erroneously stated the ovary of *Megalomyzon robustus* (the type and only species of *Megalomyzon*) as being ovoid and smooth, but Bray (2002) corrected it to trilobed based on examination of the type specimen of *M. robustus*. Therefore both



Figs. 11–13. *Neomegalomyzon physiculi* gen. and sp. nov. — 11. Entire worm, ventral view (holotype, MPM Coll. 20014). 12. Terminal genitalia, ventral view. 13. Ovarian complex, dorsal view. Abbreviations: A, acetabulum; C, cirrus sac; D, oviduct; G, genital pore; L, Laurer's canal; M, Mehlis' gland; O, ovary; P, pars prostatica; R, vitelline reservoir; S, seminal vesicle; T, testis; U, uterus.

Megalomyzon and *Neomegalomyzon* have a trilobed ovary.

Neomegalomyzon physiculi sp. nov.

(Figs. 11–13)

Material. One specimen from intestine of *Physiculus maximowiczi* (Herzenstein) (Moridae), Suruga Bay, 20-III-1974 (MPM Coll. 20014, holotype), coll. Sh. Kamegai.

Description. Based on one specimen. Body robust, ovoid, 1.98 long by 1.18 wide (Fig. 11). Tegument smooth. Oral sucker very large, 0.71×0.79; mouth opening also large; prepharynx 0.20 long; pharynx 0.18×0.28, just posterior to oral sucker; esophagus short, 0.10 long; caeca broad, extending transversely, then curved backward at each end, terminating just or shortly anterior to each testis. Acetabulum large, wider than long, 0.56×0.73, with thin transverse muscles around orifice, near posterior end of body. Sucker ratio 1 : 0.92.

Testes rounded to ovoid, symmetrical, close to lateral body margin; right testis 0.43×0.23, between right caecal termination and acetabulum; left testis 0.35×0.30, just posterior to left caecal termination and partly overlapping anterosinistral portion of acetabulum. Cirrus sac broadly claviform, transversely oriented, proximal end tapering and extending posteriorly, 0.45×0.22, sinistral, between left caecum and acetabulum; containing bipartite seminal vesicle, proximal portion 152×61 μm and distal portion 127×81 μm; pars prostatica elliptical, thick-walled, 177×78 μm, with well-developed prostatic cells; ejaculatory duct inconspicuous. Genital atrium bowl-shaped. Genital pore in contact with anterodextral edge of left testis (Fig. 12).

Ovary trilobed, 0.38×0.17, dextral, attached to left side of right testis. Oviduct arising from center of ovary, extending backward, giving off Laurer's canal near posterodextral edge of acetabulum, then forward, receiving vitelline reservoir and entering Mehlis' gland. Laurer's canal opening middorsally near anterior edge of posterior lip of acetabulum. Mehlis' gland near posterior border of ovary (Fig. 13). Uterus median, between intestinal bifurcation and acetabulum, then passing from proximal end of cirrus sac to left caecal termination, where it forms short duct lined with cilia and swelling 60×35 μm before entering short metraterm 30 μm long. Eggs 38–42×25–28 μm (42–45×25–28 μm in life). Vitellaria consisting of small follicles in two lateral clusters, either side of pharynx, between oral sucker and caeca. Excretory vesicle V-shaped with arms extending to near caeca; pore terminal.

Remarks. As described above, the present new species can be distinguished from the related *Megalomyzon robustus* Manter, 1947 by having an acetabulum near the posterior end of the body; a uterus in the middle of the body, not entering the postacetabular area; a genital pore on the anterodextral edge of the left testis; and a V-shaped excretory vesicle with arms reaching the caeca. In contrast, *M. robustus* has a subequatorial acetabulum; a uterus filling most of the postacetabular area; a genital pore at about the posterosinistral edge of the oral sucker or pharynx; and a Y-shaped excretory vesicle with arms extending to

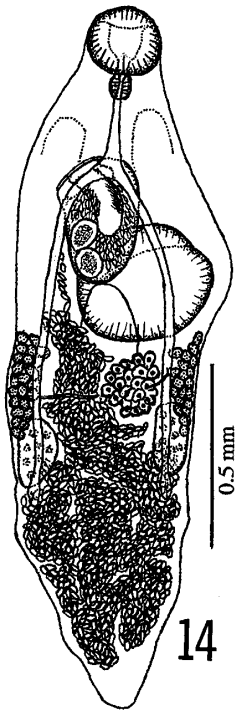


Fig. 14. *Steringophorus furciger* (Olsson, 1868). Entire worm, dorsal view (original, MPM Coll. 18110).

near the anterior end of the body.

Genus ***Steringophorus*** Odhner, 1905

Steringophorus furciger (Olsson, 1868)

(Fig. 14)

Material. Seven specimens from intestine of unidentified pleuronectid fish, Suruga Bay, 24-IV-1973 (MPM Coll. 18110), coll. Sh. Kamegai.

Additional measurements and remarks. Based on three specimens, one of which lacks anterior end. Body 1.78–1.93 long by 0.55–0.60 wide. Body width 31–32% of body length. Oral sucker 0.19–0.20×0.20–0.21; prepharynx 0.02–0.03 long; pharynx 0.06–0.08×0.05–0.07; esophagus 0.11–0.14 long. Acetabulum 0.27–0.34×0.33–0.44. Sucker ratio 1 : 1.69–1.95. Forebody 39–42% of body length. Right testis 0.17–0.22×0.11–0.14 and left testis 0.15–0.21×0.11–0.14. Posttesticular space 32–33% of body length. Cirrus sac 0.32–0.38×0.20–0.21. Ovary 0.21–0.26×0.18–0.22. Eggs 40–44×22–25 μm. Compared with measurements of *S. furciger* given by Bray and Gibson (1980, Table 2) and Bray and Campbell (1995, Table 1), our material has a thinner body width and a smaller pharynx.

Subfamily Piriforminae Skrjabin and Koval, 1957

Genus ***Piriforma*** Yamaguti, 1938

Piriforma macrorhamphosi Yamaguti, 1938

Material. Sixty specimens (including one sectioned specimen) from intestine of *Macroramphosus scolopax* (Linnaeus) (Macroramphosidae), Suruga Bay, 17-X-1973 (MPM Coll. 18252), coll. Sh. Kamegai.

Remarks. This species was previously known from *Macroramphosus scolopax* off the Pacific coast of central and western Japan (Yamaguti, 1938; Kamegai, 1974; Machida and Kamegai, 1997). Bray (2002) failed to detect a cyclocoel in Yamaguti's wholemount specimens. However, our serial sections of the worm reveal the caeca forming a cyclocoel as described by Yamaguti (1938). The serial sections also show: the seminal receptacle is absent and the proximal end of the uterus fills with sperm; Laurer's canal opens at the ovarian level; and the excretory vesicle is Y-shaped, bifurcating at the postacetabular level to form arms extending to the anterior border of the cirrus sac.

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